Software engineers face fundamental challenges

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The world's developed nations are becoming information societies that will require programmers and software engineers to resolve fundamental issues in productivity and advance key technologies to be successful, said speakers at the 11th Annual Computer Software and Applications Conference held Oct. 5-9 in Tokyo.

According to conference presentations, the key issues for software developers to address are

- how to manage software development,
- how to assure software quality,
- how to develop and apply powerful database architectures and distributed processing,
- how to integrate computer technology with people's needs through expert systems, language processing (natural and computer), data-interchange protocols, and operating systems designed for everyday users, and
- how to cope with a growing shortage of top-level programmers and software engineers caused by demand for software that is increasing twice as fast as the rate of new programmers (by 2000, Japanese government figures predict a shortfall of 970,000 programmers in Japan).

Answers did not exist for most of these issues, but participants did agree that researchers in the US, Europe, and Japan have recognized the fundamental problems now facing the software industry and have begun several comprehensive projects to investigate solutions.

"We weren't sure what to do 10 years ago, but today we know the direction we are going in," said Toshiro Ohno of the Japan Business Automation Co. at a tutorial session on the major technology effects on software engineering.

One widely held view was that software development must be treated systematically, not as one-time, ad hoc projects. "Software is [now] tailored to the individual needs of a customer, not to the general needs of the software market," said Akira Nagashima, director of microprocessor-based scientific tools for the Sigma software-development environment project, at the tutorial session. That must change, he said.

"We who are engaged in the production of software are concerned that, although it is invisible, it is a commodity that must be sold like hardware," said Tadahiro Sekimoto, president of NEC Corp. and one of Compsac's three keynote speakers. Software has development, testing, sales, and postsales service phases just like hardware, he told the 683 conference attendees.

"In the area of software, it is very important to recognize that productivity is very important," Sekimoto said. To increase productivity, "we have to rationalize it," he said. "The things software can do will be the critical paths. [But its] limits will be the limits on quality of life," he said. "Those who will be able to conquer software will be able to conquer the world," Sekimoto said.

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Information flow. Software technology must be transferred equitably among software-producing nations, said L. Desaix Anderson, the US chargé d'affaires in Japan, also at the keynote session. He called on Japan to accept the US and European format of intellectual property rights (such as copyrights), saying that "equitable transfer encourages more development . . . [while] a pattern of disputes can slow down progress." The information must flow from Japan, not just to it, he said.

The US and Japan are negotiating an umbrella science and technology agreement to equalize the flow of information between them, said William McPherson, a US Embassy second secretary specializing in science and technology policy, in an interview after the conference. "We're very interested in what they're doing in the government labs and in some private labs," he said.

The embassy has looked at two Japanese information services — the Japan Information Center for Science and Technology and the National Academic Center for Science Information Systems — that have some English indexes and abstracts. Of the several million items in the Japan Information Center, about a half million have English index information, and 1300 English entries are being added each month, McPherson said. The service is available in the US as well as in Japan. Japan has offered to give the National Science Foundation in Washington, DC, a terminal to access the other service, he said.

Japan, McPherson said, should be more forthcoming in sharing its industry-generated research and make its intellectual-property laws protect the ideas' originators longer and better. But he acknowledged that US researchers must also make an effort to get information from Japan. Very few Americans (between 100 and 150 last year) come to Japanese firms under exchange programs, and those who do stay for less than two months, he said.

Japan, too, has opened doors to foreigners that were traditionally closed, McPherson said. Japan's Science and Technology Agency, for example, has recently begun a program to hire foreigners. Under the leadership of Prime Minister Yasuhiro Nakasone, Japan has unilaterally opened some doors, McPherson said. Nakasone's term ended Oct. 20, but the three candidates to replace him have said they will continue his door-opening policies. However, the programs that have begun have very small budgets, usually less than a million dollars, McPherson said.

"We have various issues in trade, etc. that need to be resolved," NEC's Sekimoto acknowledged. But Japan is contributing substantially to software-development technology transfer, he said.

Information society. The role Japan has been playing domestically to begin transforming itself into an information society was a focus throughout the conference, held for the first time outside Chicago, partly to acknowledge Japan's increasingly major role in software research.

The Japanese government, through its Ministry of International Trade and Industry, has been especially forceful in its research efforts in productivity improvement and mass-use computing. "Our purpose is to push for an information society," said MITI Vice Minister Shizuma Kojima at the keynote session. "[But] we cannot promote this policy just as a policy of Japan. We need to cooperate," he said.

MITI has three large programs under way to help accomplish the transformation of Japan: the ICOT fifth-generation language project, the Sigma software-development environment project, and the Tron project to apply artificial intelligence and microprocessors to everyday tasks for millions of users.

The Japanese programs share a belief that expert systems will play a key role in solving user-interface, development-tool, and system-management needs, at both the development sites and in the final systems. "We need to pursue intelligence" in machines so they help the user make decisions and handle routine needs automatically when possible, Sekimoto said.

Sekimoto foresees distributed systems with common protocols for data interchange and systems that use one database with several data representations. Such systems will let the various manufacturers' systems work together, keeping development costs low and letting the average user — the shopkeeper or butcher — use computer systems without much training or effort, he said. To accomplish this, software developers must think in terms of developing systems, not just software, he said. This integrated view will help make usable, everyday systems a reality, Sekimoto said.

In the short term, the best productivity booster appears to be increasing computing power each engineer has, several speakers said — although there was some dispute over whether PCs, workstations, minicomputers, or mainframes were the best host machines.